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DESCRIPTION

[0001]
The invention relates to a method for manufacturing a composite film having at least one layer of cycloolefin copolymer (COC-layer).

[0002]
Cycloolefin films have outstanding properties as a steam barrier layer; however due to their brittleness they cannot automatically be used with other materials, or to self seal or be deep drawn.

[0003]
The basic object of the invention is to demonstrate a method by which above all the deep draw capability of cycloolefin films is improved.

[0004]
This object is solved, in accordance with the invention, by providing the COC-layer with a polyolefin layer, at least on one side.

[0005]
Polyolefin has very good deep draw capability as well as good sealability. In accordance with the invention, these properties are at least partly transferred in the case of combining at least one polyolefin layer with the COC-layer, without altering its inherently positive properties. Moreover, sensitivity to grease especially is eliminated thereby.

[0006]
It was found to be particularly advantageous when, in accordance with another embodiment of the invention, the COC-layer has a polyolefin layer on both sides.

[0007]
By embedding the COC-layer on both sides with polyolefin the deep draw capability of the composite is still further improved. The higher brittleness of the COC layer is thereby equalized.

[0008]
A further advantageous embodiment of the invention is provided in that the COC-layer and the other layers are produced via the flat-film extrusion method.

[0009]
Such composite film are especially convenient to manufacture by means of the flat-film extrusion method.

[0010]
It is however also possible, in accordance with another embodiment of the invention, that the COC-layer and the other layers be manufactured via the extrusion blow mold method.

[0011]
Very favorable film properties result if, in accordance with another embodiment of the invention, a stretching procedure of the composite film is connected downstream to the extrusion process.

[0012]
It is likewise very advantageous if, in accordance with another embodiment of the invention, the outer layers are joined to the COC-layer by means of a bonding agent.

[0013]
By the use of bonding agent layers almost any desired polyolefins can be utilized as the outer layers for the COC-layer.

[0014]
An advantageous embodiment of the invention is characterized in that LDPE is utilized as the outer layer.

[0015]
It has been shown to be very advantageous to employ LDPE having a density from 0.915 to 0.925.

[0016]
However it is also possible in accordance with another embodiment of the invention that VLDPE, preferably with a density of from 0.860 to 0.910, be utilized as the outer layer.

[0017]
Another possibility for covering the COC-layer comprises, in accordance with the invention, is to use LLDPE having a preferred density of 0.910 to 0.935 as outer layer for the COC.

[0018]
It has likewise been proved very favorable if, in accordance with another advantageous embodiment of the invention, COC is provided with an outer layer comprised of MDPE that preferably has a density of 0.930 to 0.946.

[0019]
Another advantageous embodiment of the invention is that as outer layer for the COC, HDPE having a preferred density of 0.944 to 0.962 is utilized.

[0020]
Another embodiment of the invention is characterized in that as outer layer for the COC, bimodal LLDPE having a preferred density of 0.910 to 0.935 is provided.

[0021]
It is likewise very advantageous when in accordance with the invention the COC is provided with a layer comprised of bimodal HDPE, that preferably has a density from 0.944 to 0.962.

[0022]
It has also proved to be very favorable, in accordance with another embodiment of the invention, that PP preferably having a density of 0.905 be provided as outer layer for the COC.

[0023]
However is also possible that, in accordance with another embodiment of the invention, a plastomer having a preferred density of 0.87 to 0.89 be provided as the outer layer.

[0024]
Another advantageous embodiment of the invention is characterized in that the bonding agent provided between the COC layer and the outer layer consists of a linear polyethylene.

[0025]
A wider range of choice of outer layer is afforded by use of a bonding agent of linear polyethylene.

[0026]
In accordance with an advantageous further embodiment of the invention the linear polyethylene can be modified by means of copolymerizates.

[0027]
In that connection it was shown to be particularly advantageous when, in accordance with another embodiment of the invention, anhydride-modified ethylene vinyl acetates are utilized for the modification.

[0028]
It is however also possible, in accordance with the invention, that ethylene acrylic acids are utilized for the modification.

[0029]
Another advantageous embodiment of the invention is characterized in that polyolefin elastomers having a density in the range from 0.860 to 0.914 g/cm^3 are employed for the modification.

[0030]
As very advantageous, it has been found, in accordance with another embodiment of the invention, that the cycloolefin copolymer has a density of approximately 1.02 g/cm^3.

[0031]
In this connection it is particularly advantageous that, in accordance with the invention, the Melt Flow Indices of the COC lie between 1.0 and 10 (230 °C/2.16 kg).

[0032]
In an embodiment example of the invention a film composite is prepared by means of the casting method. A Breitschlitz Extruder having five extruders is provided for preparation of the composite film. For that, the central extruder is provided for the cycloolefin copolymer. The two outer extruders on the other hand deliver the material for the outer layer. Between the central extruder and the two outer extruders there are additional extruders, which in each case are provided for the bonding agent.

[0033]
These five extruders are connected together in a common feedblock, wherein the material streams are fed together and from where they arrive together at the exit nozzles.

[0034]
A linear polyethylene which is modified by means of copolymerizates, is provided as bonding agent.

[0035]
One of the outer layers comprises LDPE having a density of 0.918 g/cm^3, while for the other outer layer PP having a density of 0.905 g/cm^3 is used.

[0036]
By means of these two outer layers which are each firmly bonded to the inner cycloolefin copolymer layer by bonding agent, the composite film has very good deep draw capability, although with only one COC film this is only possible to a limited extent.

[0037]
As the outer layers, either the same or different polyolefins can be used on both sides.

[0038]
The following outer layer materials are worth considering, in particular:

LDPE	Density 0.915 to 0.925 g/cm^3
VLDPE	Density 0.880 to 0.910 g/cm^3
LLDPE	Density 0.910 to 0.935 g/cm^3
MDPE	Density 0.930 to 0.946 g/cm^3
HDPE	Density 0.944 to 0.962 g/cm^3
LLDPE (bimodal	Density 0.910 to 0.935 g/cm^3
HDPE (bimodal)	Density 0.944 to 0.962 g/cm^3
PP	Density 0.905 g/cm^3
Plastomer	Density 0.87 to 0.89 g/cm^3

[0039]
As bonding agent can be employed above all:

linear polyethylene:
via copolymer modified polyethylene;
via anhydride ethylvinylacetate modified PE;
via ethylene acrylic acids modified PE;
via polyolefin elastomers having a density in the range from 0.860 to 0.914 g/cm^3, modified polyethylene.

[0040]
The cycloolefin copolymer employed has a density of approximately 1.02 g/cm^3 and the Melt Flow Indices are between 1.0 and 10 (230 °C/2.16 kg).

[0041]
Different choices, which also contain other materials, are possible both for the outer layers and the bonding agents.